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PATENT ABSTRACTS OF JAPAN

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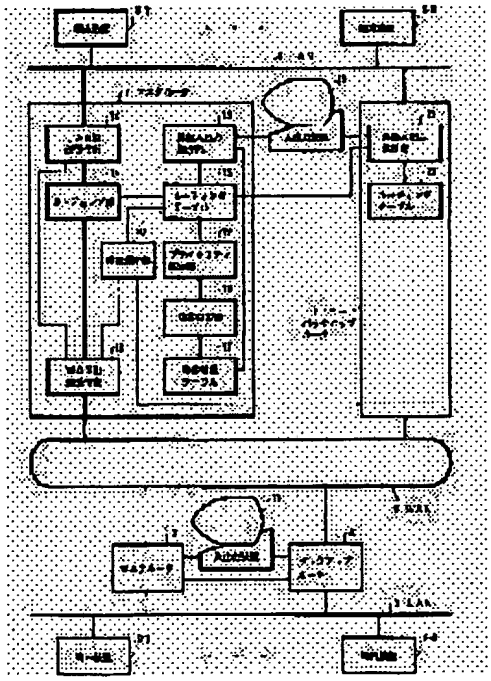
(54) NETWORK SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To allow the system to conduct restoration processing in a short time on the occurrence of a fault in a router, in the case that a plurality of LANs are interconnected via routers and a WAN.

SOLUTION: A routing table 15 stores dial numbers of master routers and backup routers connecting to each LAN being a communication opposite party of a LAN 5 and priority of each LAN network, the master routers and the backup routers (the master routers have higher priority than other routers, when the master routers are normal). In the case of sending a packet to a terminal equipment connecting to a LAN, a routing section 14 refers to the routing table 15 to send a packet any router having a higher priority among the master routers and the backup routers connecting to the LAN. A priority revision section 19 sets lower priority to a master router than that of backup routers, when the fault takes place in the master routers.



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CLAIMS

[Claim(s)]
[Claim 1] Two or more LANs are connected to WAN through the backup router started at the time of failure generating of a master router and this master router, respectively. In the network system with which the terminal unit connected to said each LAN communicates mutually through said WAN Said each master router and said each backup router for every LAN connected with the self-router through said WAN The routing information for transmitting the packet which makes the destination the terminal unit connected to the LAN to the master router or backup router with which it connects with the LAN, The routing table which matched and stored the effective information which shows any of the master router connected to the LAN, and the backup routers are effective, When the packet which makes the destination the terminal unit connected to other LANs on LAN to which the self-router is connected appears, The routing section which transmits said packet to the router with which said effective information of the master router connected to LAN besides the above and the backup routers shows the owner effect with reference to said routing table, The inside of the effective information stored in said routing table when failure generating is notified from other master routers, The effective information corresponding to LAN to which the master router which notified said failure generating is connected It has an effective change information means to change into what shows that a backup router is effective, from what shows that a master router is effective. When said each master router detects the failure of a self-master router, while starting the backup router which is a self-master router and a pair The network system characterized by equipping the master router which shows that effective information is effective, and a backup router with the notice section of a failure which notifies failure generating with reference to said routing table in a self-master router.
[Claim 2] Said each backup router is a network system according to claim 1 characterized by having the configuration which copies the contents of the routing table in the master router which is a self-backup router and a pair to the routing table in a self-backup router by being started.
[Claim 3] Said effective information is a network system according to claim 2 characterized by consisting of a priority of a master router, and a priority of a backup router.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the failure restoration technique at the time of a failure occurring in a master router especially about the network system with which the terminal unit by which connected with WAN through the master router and the backup router, respectively, and two or more LANs were connected to each LAN communicates mutually through WAN.
[0002]
[Description of the Prior Art] In order that the terminal unit by which connected with WAN through the router, respectively and two or more LANs were connected to each LAN may raise dependability in the network system which communicates mutually through WAN, an optimal path is chosen with the routing algorithm (RIP) which a router performs, and bypassing a router path with failure is performed from the former. By the way, in RIP, as shown in drawing 10 , while connecting LAN104 and WAN105 through the master router 100, it connects through the backup router 101, WAN106, and the backup router 102. And when a packet is transmitted and received through the master router 100 when the master router 100 is normal, and a failure occurs in the master router 100, a packet is transmitted and received through the alternate route which consists of a backup router 101, WAN106, and a backup router 102 (Nikkei Business Publications, "the technique of LAN construction", P228 - P November20, 1990 [229 or] issue). However, with this conventional technique, when a failure occurs in the master router 100, it becomes that from which the path to be used differs, and there is a problem of it becoming impossible to use a circuit to use originally.
[0003] Since such a trouble is solved, it is possible to make it shown in drawing 11 . The master router 110 corresponding to LAN114 and the backup router 111 are connected to LAN114 while connecting with the circuit from which WAN116 differs, respectively, and the master router 112 corresponding to LAN115 and the backup router 113 are connected to LAN115 while connecting with the circuit from which WAN116 differs, respectively. moreover, in the master router 110 and the backup router 111 As shown in drawing 12 (A), number-to-be-dialed Y of the master router 112, The routing table in which the network address y of LAN115 where the master router 112 is connected was stored by matching is prepared. In the master router 112 and the backup router 113, as shown in drawing 12 (B), number-to-be-dialed X of the master router 110 and the network address x of LAN114 where the master router 110 is connected match, and are stored. In addition, the number to be dialed of the backup router 111,113 is taken as X' and the thing used as Y', respectively.
[0004] The following actuation is performed when both the master routers 110,112 are normal. If terminal unit 117-i (1 <=i<=N) connected to LAN114 outputs the packet of addressing to terminal unit 118-j (1 <=j<=M) connected to LAN115 on LAN114, the master router 110 It asks for the network address y of LAN115 where terminal unit 118-j is connected based on the IP address of terminal unit 118-j added to the packet. Furthermore, it asks for number-to-be-dialed Y of the master router 112 with reference to the routing table shown in drawing 12 (A). Then, the master router 110 adds number-to-be-dialed Y to the above-mentioned packet, and sends it out to WAN116. The master router 112 sends out a

packet to LAN115 to which terminal unit 118-j which is the destination is connected, if the above-mentioned packet is received.
[0005] Next, actuation when a failure occurs in the master router 112 is explained. If a failure occurs in the master router 112, the master router 112 will transmit the packet for the notice of failure generating to the router of all the numbers to be dialed stored there with reference to the routing table shown in drawing 12 (B). Since only number-to-be-dialed X is stored in routing table in the case of this example, the master router 112 transmits the packet for the notice of failure generating only to the master router 110 of number-to-be-dialed X. Then, the master router 112 starts the backup router 113, and suspends own actuation.
[0006] The master router 110 will display that the failure occurred in the master router 112 on a display (not shown), if the packet for the notice of failure generating is sent from the master router 112. The manager of LAN114 who looked at that display investigates the number to be dialed (in the case of this example Y') of the backup router 113 which is the master router 112 which the failure generated, and a pair first. Then, a manager rewrites using input devices (not shown), such as a keyboard, to what shows the contents of the routing table in the master router 110,111 to drawing 12 (C) from what is shown in drawing 12 (A). That is, a number to be dialed is rewritten from number-to-be-dialed [of the master router 112] Y to number-to-be-dialed Y' of the backup router 113.
[0007] If the packet addressed to terminal unit 118-j is outputted from terminal unit 117-i after the contents of routing table are rewritten by what is shown in drawing 12 (C), the master router 110 adds number-to-be-dialed Y' of the backup router 113 to the packet, and sends it out to WAN116. Consequently, the above-mentioned packet will be sent to terminal unit 118-j through the backup router 113 of number-to-be-dialed Y', and LAN115.
[0008]
[Problem(s) to be Solved by the Invention] If it is made to mention above, it will become possible to cope with the failure of a master router, without changing the communication path in front of a failure, but while failure restoration takes time amount since a manager has to rewrite the contents of the routing table in other master routers and a backup router when a failure occurs in a certain master router, there is a problem that a burden is placed on a manager.
[0009] Then, the purpose of this invention is to offer the network system which can perform failure restoration in a short time, without not needing a change-over circuit and applying a burden to a manager.
[0010]
[Means for Solving the Problem] In order that this invention may attain the above-mentioned purpose, two or more LANs are connected to WAN through the backup router started at the time of failure generating of a master router and this master router, respectively. In the network system with which the terminal unit connected to said each LAN communicates mutually through said WAN Said each master router and said each backup router for every LAN connected with the self-router through said WAN The routing information for transmitting the packet which makes the destination the terminal unit connected to the LAN to the master router or backup router with which it connects with the LAN, The routing table which matched and stored the effective information which shows any of the master router connected to the LAN, and the backup routers are effective, When the packet which makes the destination the terminal unit connected to other LANs on LAN to which the self-router is connected appears, The routing section which transmits said packet to the router with which said effective information of the master router connected to LAN besides the above and the backup routers shows the owner effect with reference to said routing table, The inside of the effective information stored in said routing table when failure generating is notified from other master routers, The effective information corresponding to LAN to which the master router which notified said failure generating is connected It has an effective change information means to change into what shows that a backup router is effective, from what shows that a master router is effective. When said each master router detects the failure of a self-master router, while starting the backup router which is a self-master router and a pair With reference to said routing table in a self-master router, the master router which shows that effective information is effective, and the

backup router are equipped with the notice section of a failure which notifies failure generating.
[0011] the account of a top of the effective information for which, as for a certain master router, the failure is stored in notice **** and the routing table in a self-router from other master routers in the above-mentioned configuration -- it changes into what shows that a backup router is effective from what shows that a master router is effective in the effective information corresponding to LAN to which a certain master router is connected. therefore, the account of after that and a top -- the packet which makes the destination the terminal unit connected to LAN to which a certain master router is connected -- the account of a top -- it will be sent to the above-mentioned terminal unit through the backup router which is a certain master router and pair.
[0012] Moreover, in order to enable it to succeed immediately the processing to which the backup router which is the master router and pair was carrying out this invention with the master router when a master router became a failure, said each backup router is equipped with the configuration which copies the contents of the routing table in the master router which is a self-backup router and a pair to the routing table in a self-backup router by being started.
[0013] In the above-mentioned configuration, if each backup router is started from the master router used as a pair, it will copy the contents of the routing table in a master router to the routing table in a self-backup router.
[0014]
[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained to a detail with reference to a drawing.
[0015] Drawing 1 is the block diagram of the example of this invention, and is equipped with the master routers 1 and 3, the backup routers 2 and 4, LANs 5 and 7, WAN6, a terminal unit 8-1 - 8-N, 9-1 - 9-M, and I/O devices 10 and 11 that consist of a keyboard, CRT, etc.
[0016] Two or more terminal units 8-1 - 8-N are connected to LAN5. The master router 1 and the backup router 2 are connected to the circuit from which WAN6 differs while connecting with LAN5. Moreover, two or more terminal units 9-1 - 9-M are connected to LAN7. The master router 3 and the backup router 4 are connected to the circuit from which WAN6 differs while connecting with LAN7.
[0017] The master router 1 is equipped with the LAN side transceiver section 12, the WAN side transceiver section 13, the routing section 14, routing table 15, the external I/O processing section 16, the fault information table 17, the failure judging section 18, the priority modification section 19, and the notice section 20 of a failure.
[0018] LAN which communicates with LAN5 through WAN6 as shown in routing table 15 at drawing 2 (in drawing 1) although only LAN7 exists, actual more many LANs communicate with LAN5 through WAN -- every -- with the number to be dialed of the master router connected to the LAN, and a backup router The network address of the LAN and the priority of the master router connected to the LAN and a backup router are stored. In drawing 2 , the information stored in the 1st field #1 is a thing about LAN7, and the information stored after 2nd field #2 is a thing about other LANs which omitted illustration in drawing 1 . At this example, the number to be dialed of the master router 3 and the backup router 4 supposes that the network address of LAN7 is "a" by "A" and "A'", respectively so that the 1st contents of field #1 shown in drawing 2 may show. Moreover, in the initial state, the priority of "1" with the highest priority of a master router and a backup router is "2" to the degree. [high]
[0019] The fault information table 17 consists of a failure generating display 17-1 and the fault information section 17-2, as shown in drawing 3 .
[0020] The LAN side transceiver section 12 has the function which outputs the packet which makes the destination the terminal unit connected to other LANs on LAN5, or the packet passed from the WAN side transceiver section 13 while having the function to pass the packet to the routing section 14, when it appeared to LAN5.
[0021] The function to pass the packet which made the destination terminal unit 8-i (1 <=i<=N) to which the WAN side transceiver section 13 has been sent through WAN6 to the LAN side transceiver section 12, The function which outputs the packet outputted from the routing section 14 to WAN6, When the packet which shows failure generating from other master routers has been sent, while writing

the information "ON" which shows failure generating in the failure generating display 17-1 of the fault information table 17, it has the function which writes in the fault information included in the fault information section 17-2 at the packet.
[0022] The routing section 14 has the function to perform routing processing based on the contents of routing table 15, when a packet is passed from the LAN side transceiver section 12.
[0023] According to the directions of a manager inputted from I/O device 10, initial information is written in routing table 15, or the external I/O processing section 16 has the function which outputs the information stored in routing table 15 and the fault information table 17 to I/O device 10.
[0024] The failure judging section 18 monitors the failure generating display 17-1 continuously, when it is judged that the contents of the failure generating display 17-1 are turned "on", asks for the master router which the failure generated based on the newest fault information stored in the fault information section 17-2, and has the function to pass the network address of LAN where it is connected further to the priority modification section 19.
[0025] The priority modification section 19 has the function to change into lowest "F" the priority of the master router corresponding to the above LAN stored in routing table 15 from "1" based on the network address of LAN passed from the failure judging section 18. [highest]
[0026] When it detects that the failure generated the notice section 20 of a failure in the master router 1, It asks for the number to be dialed of a master router and a backup router which should transmit the packet for the notice of failure generating with reference to routing table 15. When it detects that the failure generated the packet for the notice of a failure which added the number to be dialed in the function outputted to WAN6, and the master router 1, after starting the backup router 2, it has the function to stop actuation of the master router 1.
[0027] The master router 3 has the same configuration as the master router 1. Moreover, although it has the configuration as the master router 1 also with the almost same backup routers 2 and 4, the notice section 20 of a failure is not formed in the backup routers 2 and 4, but the external I/O processing section 21 in the backup router 2 has further the function which copies the contents of routing table 15 other than the function with which the external I/O processing section 16 in the master router 1 is equipped to routing table 22 at the time of starting in them. In addition, the backup router 2, the external I/O processing section 21 in four, and each part other than routing table 22 are omitting illustration.
[0028] The flow chart in which drawing 4 shows the example of processing of the LAN side transceiver section 12, the flow chart in which drawing 5 shows the example of processing of the routing section 14, the flow chart in which drawing 6 shows the example of processing of the WAN side transceiver section, the flow chart in which drawing 7 shows the example of the failure judging section 18 of processing, the flow chart in which drawing 8 shows the example of the priority modification section 19 of processing, and drawing 9 are the flow charts showing the example of the notice section 20 of a failure of processing, and actuation of this example explains with reference to each drawing below.
[0029] First, actuation when both the master routers 1 and 3 are operating normally is explained.
[0030] The LAN side transceiver section 12 will output the packet to the routing section 14, if the packet (for example, packet which makes the destination terminal unit 9-j connected to LAN7) which makes the destination the terminal unit connected to other LANs on LAN5 appears (drawing 4 and S1 are YES) (S2).
[0031] If the above-mentioned packet is passed, the routing section 14 will ask for the network address a of LAN7 where terminal unit 9-j is connected based on the predetermined bit of the high order of the IP address which shows terminal unit 9-j added to it, and will look for the field where routing table 15 is searched and the network address a is stored further (drawing 5 , S11). Supposing the contents of now 15, for example, routing table, show drawing 2 , the routing section 14 will discover the 1st field #1.
[0032] Then, it judges whether the priority of the master router stored in field #1 of the routing section 14 is higher than the priority of a backup router (S12). Since in the case of this example the priority of a master router is "1" and the priority of a backup router is "2", the decision result of S12 serves as YES. When the decision result of S12 serves as YES, the routing section 14 passes the packet which added number-to-be-dialed A of the master router stored in field #1 to the packet passed from the LAN side

transceiver section 12 to the WAN side transceiver section 13 (S13).
[0033] The WAN side transceiver section 13 will output the packet to WAN6, if the packet to which number-to-be-dialed A was added from the routing section 14 is passed (drawing 6 and S21 are NO) (S22). Thereby, as for the above-mentioned packet, a number to be dialed is sent to the master router 3 of "A", and the master router 3 is outputted to LAN7 to which this packet is connected in terminal unit 9-j.
[0034] Moreover, when the packet to which the WAN side transceiver section 13 makes the destination terminal unit 8-i connected to LAN5 through WAN6 has been sent, (S21 and S23 pass YES, NO), and its packet to the LAN side transceiver section 12, respectively (S25).
[0035] If a packet is passed from the WAN side transceiver section 13, as for the LAN side transceiver section 12, (drawing 4 and S1 will output the above-mentioned packet to YES) and LAN5 (S3). Thereby, terminal unit 8-i receives the above-mentioned packet.
[0036] Next, a failure occurs in the master router 3 and actuation in case the packet which shows failure generating from the master router 3 to the master router 1 has been sent is explained.
[0037] The WAN side transceiver section 13 of the master router 1 writes in the fault information included in the fault information section 17-2 at the packet while writing the information "ON" which shows failure generating in the failure generating display 17-1 of the fault information table 17, if the packet which shows that the failure occurred in the master router 3 through WAN6 is received (both drawing 6 , and S21 and S23 are YES) (S24).
[0038] If the failure generating display 17-1 is monitored continuously and the contents serve as "ON" (drawing 7 and S31 are YES), the failure judging section 18 will ask for the master router 3 which the failure generated based on the newest fault information stored in the fault information section 17-2, will ask for the network address a of LAN7 where the master router 3 is connected further, and will notify it to the priority modification section 19 (S32). Then, the failure judging section 18 changes the contents of the failure generating display 17-1 at "OFF" (S33).
[0039] The priority modification section 19 searches routing table 15 based on the network address a of LAN7 passed from the failure judging section 18, and looks for a field including a network address a (drawing 8 , S41). In the case of this example, the 1st field #1 of routing table 15 is discovered (refer to drawing 2). Then, the priority modification section 19 changes into "F" from "1" the priority of the master router 3 stored in field #1 discovered by S41 (S42).
[0040] The following actuation is performed, when the packet which makes the destination terminal unit 9-j connected to LAN7 appears on LAN5 after the priority of the master router 3 was changed into "F" from "1."
[0041] If the packet which makes terminal unit 9-j the destination appears on LAN5, the LAN side transceiver section 12 will pass the packet to the routing section 14 (drawing 4 , S1, S2).
[0042] If the above-mentioned packet is passed, the routing section 14 will perform same processing with having mentioned above, and will discover the 1st field #1 of routing table 15 (drawing 5 , S11). Then, the priorities of the master router stored in field #1 and a backup router are "F" and "2", respectively, and since the priority of a master router is lower, the routing section 14 passes the packet which added number-to-be-dialed A' of the backup router stored in field #1 to the packet to which (S12 were passed from NO) and the LAN side transceiver section at the WAN side transceiver section 13 (S14).
[0043] The WAN side transceiver section 13 will output the packet to WAN6, if the packet to which number-to-be-dialed A' was added from the routing section 14 is passed (drawing 6 and S21 are NO) (S22). Thereby, as for the above-mentioned packet, a number to be dialed is sent to the backup router 4 of "A'", and the backup router 4 outputs this packet to LAN7.
[0044] Next, actuation when a failure occurs in the master router 1 is explained.
[0045] when it detects that the failure generated the notice section 20 of a failure in the master router 1 in the master router 1, it is shown in the flow chart of drawing 9 -- as -- first -- routing table 15 -- each -- the priority of the numbers to be dialed of the master router stored in every field #1, #2, and -- to the field and a backup router acquires the number to be dialed of the higher one (S51). Then, the acquired

packet for the notice of failure generating which added the number to be dialed for every number to be dialed is created, and each created packet is outputted to WAN6 through the WAN side transceiver section 13 (S52).

[0046] Subsequently, the notice section 20 of a failure outputs an error message to I/O device 10 while starting the backup router 2 which is the master router 1 and a pair (S53), and it stops the master router 1 further (S54).

[0047] If the external I/O processing section 21 in the backup router 2 is started, it will copy the contents of the routing table 15 in the master router 1 to the routing table 22 in the backup router 2. It enables this to succeed immediately the processing which the master router 1 was performing with the backup router 2.

[0048]

[Effect of the Invention] As explained above, when, as for this invention, failure generating is notified from other master routers, The inside of the effective information stored in the routing table in a self-master router, The effective information corresponding to LAN to which the master router which the failure generated is connected Since it has effective change information means, such as the priority modification section changed into what shows that a backup router is effective, from what shows that a master router is effective Failure restoration can be performed in a short time, without [without it prepares a change-over circuit, and] applying a burden to a manager.

[0049] Moreover, since the backup router which is it and a pair copies the contents of the routing table in a master router to the routing table in a self-backup router when a failure occurs in a master router, this invention can succeed processing immediately with a backup router, when a failure occurs in a master router.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the failure restoration technique at the time of a failure occurring in a master router especially about the network system with which the terminal unit by which connected with WAN through the master router and the backup router, respectively, and two or more LANs were connected to each LAN communicates mutually through WAN.

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PRIOR ART

[Description of the Prior Art] In order that the terminal unit by which connected with WAN through the router, respectively and two or more LANs were connected to each LAN may raise dependability in the network system which communicates mutually through WAN, an optimal path is chosen with the routing algorithm (RIP) which a router performs, and bypassing a router path with failure is performed from the former. By the way, in RIP, as shown in drawing 10 , while connecting LAN104 and WAN105 through the master router 100, it connects through the backup router 101, WAN106, and the backup router 102. And when a packet is transmitted and received through the master router 100 when the master router 100 is normal, and a failure occurs in the master router 100, a packet is transmitted and received through the alternate route which consists of a backup router 101, WAN106, and a backup router 102 (Nikkei Business Publications, "the technique of LAN construction", P228 - P November20, 1990 [229 or] issue). However, with this conventional technique, when a failure occurs in the master router 100, it becomes that from which the path to be used differs, and there is a problem of it becoming impossible to use a circuit to use originally.
[0003] Since such a trouble is solved, it is possible to make it shown in drawing 11 . The master router 110 corresponding to LAN114 and the backup router 111 are connected to LAN114 while connecting with the circuit from which WAN116 differs, respectively, and the master router 112 corresponding to LAN115 and the backup router 113 are connected to LAN115 while connecting with the circuit from which WAN116 differs, respectively. moreover, in the master router 110 and the backup router 111 As shown in drawing 12 (A), number-to-be-dialed Y of the master router 112, The routing table in which the network address y of LAN115 where the master router 112 is connected was stored by matching is prepared. In the master router 112 and the backup router 113, as shown in drawing 12 (B), number-to-be-dialed X of the master router 110 and the network address x of LAN114 where the master router 110 is connected match, and are stored. In addition, the number to be dialed of the backup router 111,113 is taken as X' and the thing used as Y', respectively.
[0004] The following actuation is performed when both the master routers 110,112 are normal. If terminal unit 117-i (1 <=i<=N) connected to LAN114 outputs the packet of addressing to terminal unit 118-j (1 <=j<=M) connected to LAN115 on LAN114, the master router 110 It asks for the network address y of LAN115 where terminal unit 118-j is connected based on the IP address of terminal unit 118-j added to the packet. Furthermore, it asks for number-to-be-dialed Y of the master router 112 with reference to the routing table shown in drawing 12 (A). Then, the master router 110 adds number-to-be-dialed Y to the above-mentioned packet, and sends it out to WAN116. The master router 112 sends out a packet to LAN115 to which terminal unit 118-j which is the destination is connected, if the above-mentioned packet is received.
[0005] Next, actuation when a failure occurs in the master router 112 is explained. If a failure occurs in the master router 112, the master router 112 will transmit the packet for the notice of failure generating to the router of all the numbers to be dialed stored there with reference to the routing table shown in drawing 12 (B). Since only number-to-be-dialed X is stored in routing table in the case of this example, the master router 112 transmits the packet for the notice of failure generating only to the master router

110 of number-to-be-dialed X. Then, the master router 112 starts the backup router 113, and suspends own actuation.

[0006] The master router 110 will display that the failure occurred in the master router 112 on a display (not shown), if the packet for the notice of failure generating is sent from the master router 112. The manager of LAN114 who looked at that display investigates the number to be dialed (in the case of this example Y') of the backup router 113 which is the master router 112 which the failure generated, and a pair first. Then, a manager rewrites using input devices (not shown), such as a keyboard, to what shows the contents of the routing table in the master router 110,111 to drawing 12 (C) from what is shown in drawing 12 (A). That is, a number to be dialed is rewritten from number-to-be-dialed [of the master router 112] Y to number-to-be-dialed Y' of the backup router 113.

[0007] If the packet addressed to terminal unit 118-j is outputted from terminal unit 117-i after the contents of routing table are rewritten by what is shown in drawing 12 (C), the master router 110 adds number-to-be-dialed Y' of the backup router 113 to the packet, and sends it out to WAN116. Consequently, the above-mentioned packet will be sent to terminal unit 118-j through the backup router 113 of number-to-be-dialed Y', and LAN115.

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EFFECT OF THE INVENTION

[Effect of the Invention] It has effective change-information means, such as the priority modification section changed into what shows that a backup router is effective, from what shows that a master router is effective in the effective information corresponding to LAN to which the master router which the failure of the effective information stored in the routing table in a self-master router generated is connected when failure generating is notified from other master routers in this invention, as explained above. Therefore, failure restoration can be performed in a short time, without [without it prepares a change-over circuit, and] applying a burden to a manager.
[0049] Moreover, since the backup router which is it and a pair copies the contents of the routing table in a master router to the routing table in a self-backup router when a failure occurs in a master router, this invention can succeed processing immediately with a backup router, when a failure occurs in a master router.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] If it is made to mention above, it will become possible to cope with the failure of a master router, without changing the communication path in front of a failure, but while failure restoration takes time amount since a manager has to rewrite the contents of the routing table in other master routers and a backup router when a failure occurs in a certain master router, there is a problem that a burden is placed on a manager.
[0009] Then, the purpose of this invention is to offer the network system which can perform failure restoration in a short time, without not needing a change-over circuit and applying a burden to a manager.

[Translation done.]

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MEANS

[Means for Solving the Problem] In order that this invention may attain the above-mentioned purpose, two or more LANs are connected to WAN through the backup router started at the time of failure generating of a master router and this master router, respectively. In the network system with which the terminal unit connected to said each LAN communicates mutually through said WAN Said each master router and said each backup router for every LAN connected with the self-router through said WAN The routing information for transmitting the packet which makes the destination the terminal unit connected to the LAN to the master router or backup router with which it connects with the LAN, The routing table which matched and stored the effective information which shows any of the master router connected to the LAN, and the backup routers are effective, When the packet which makes the destination the terminal unit connected to other LANs on LAN to which the self-router is connected appears, The routing section which transmits said packet to the router with which said effective information of the master router connected to LAN besides the above and the backup routers shows the owner effect with reference to said routing table, The inside of the effective information stored in said routing table when failure generating is notified from other master routers, The effective information corresponding to LAN to which the master router which notified said failure generating is connected It has an effective change information means to change into what shows that a backup router is effective, from what shows that a master router is effective. When said each master router detects the failure of a self-master router, while starting the backup router which is a self-master router and a pair With reference to said routing table in a self-master router, the master router which shows that effective information is effective, and the backup router are equipped with the notice section of a failure which notifies failure generating.
[0011] the account of a top of the effective information for which, as for a certain master router, the failure is stored in notice **** and the routing table in a self-router from other master routers in the above-mentioned configuration -- it changes into what shows that a backup router is effective from what shows that a master router is effective in the effective information corresponding to LAN to which a certain master router is connected. therefore, the account of after that and a top -- the packet which makes the destination the terminal unit connected to LAN to which a certain master router is connected -- the account of a top -- it will be sent to the above-mentioned terminal unit through the backup router which is a certain master router and pair.
[0012] Moreover, in order to enable it to succeed immediately the processing to which the backup router which is the master router and pair was carrying out this invention with the master router when a master router became a failure, said each backup router is equipped with the configuration which copies the contents of the routing table in the master router which is a self-backup router and a pair to the routing table in a self-backup router by being started.
[0013] In the above-mentioned configuration, if each backup router is started from the master router used as a pair, it will copy the contents of the routing table in a master router to the routing table in a self-backup router.
[0014]
[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained to a detail

with reference to a drawing.
[0015] Drawing 1 is the block diagram of the example of this invention, and is equipped with the master routers 1 and 3, the backup routers 2 and 4, LANs 5 and 7, WAN6, a terminal unit 8-1 - 8-N, 9-1 - 9-M, and I/O devices 10 and 11 that consist of a keyboard, CRT, etc.
[0016] Two or more terminal units 8-1 - 8-N are connected to LAN5. The master router 1 and the backup router 2 are connected to the circuit from which WAN6 differs while connecting with LAN5. Moreover, two or more terminal units 9-1 - 9-M are connected to LAN7. The master router 3 and the backup router 4 are connected to the circuit from which WAN6 differs while connecting with LAN7.
[0017] The master router 1 is equipped with the LAN side transceiver section 12, the WAN side transceiver section 13, the routing section 14, routing table 15, the external I/O processing section 16, the fault information table 17, the failure judging section 18, the priority modification section 19, and the notice section 20 of a failure.
[0018] LAN which communicates with LAN5 through WAN6 as shown in routing table 15 at drawing 2 (in drawing 1) although only LAN7 exists, actual more many LANs communicate with LAN5 through WAN -- every -- with the number to be dialed of the master router connected to the LAN, and a backup router The network address of the LAN and the priority of the master router connected to the LAN and a backup router are stored. In drawing 2 , the information stored in the 1st field #1 is a thing about LAN7, and the information stored after 2nd field #2 is a thing about other LANs which omitted illustration in drawing 1 . At this example, the number to be dialed of the master router 3 and the backup router 4 supposes that the network address of LAN7 is "a" by "A" and "A'", respectively so that the 1st contents of field #1 shown in drawing 2 may show. Moreover, in the initial state, the priority of "1" with the highest priority of a master router and a backup router is "2" to the degree. [high]
[0019] The fault information table 17 consists of a failure generating display 17-1 and the fault information section 17-2, as shown in drawing 3 .
[0020] The LAN side transceiver section 12 has the function which outputs the packet which makes the destination the terminal unit connected to other LANs on LAN5, or the packet passed from the WAN side transceiver section 13 while having the function to pass the packet to the routing section 14, when it appeared to LAN5.
[0021] The function to pass the packet which made the destination terminal unit 8-i (1 <=i<=N) to which the WAN side transceiver section 13 has been sent through WAN6 to the LAN side transceiver section 12, The function which outputs the packet outputted from the routing section 14 to WAN6, When the packet which shows failure generating from other master routers has been sent, while writing the information "ON" which shows failure generating in the failure generating display 17-1 of the fault information table 17, it has the function which writes in the fault information included in the fault information section 17-2 at the packet.
[0022] The routing section 14 has the function to perform routing processing based on the contents of routing table 15, when a packet is passed from the LAN side transceiver section 12.
[0023] According to the directions of a manager inputted from I/O device 10, initial information is written in routing table 15, or the external I/O processing section 16 has the function which outputs the information stored in routing table 15 and the fault information table 17 to I/O device 10.
[0024] The failure judging section 18 monitors the failure generating display 17-1 continuously, when it is judged that the contents of the failure generating display 17-1 are turned "on", asks for the master router which the failure generated based on the newest fault information stored in the fault information section 17-2, and has the function to pass the network address of LAN where it is connected further to the priority modification section 19.
[0025] The priority modification section 19 has the function to change into lowest "F" the priority of the master router corresponding to the above LAN stored in routing table 15 from "1" based on the network address of LAN passed from the failure judging section 18. [highest]
[0026] When it detects that the failure generated the notice section 20 of a failure in the master router 1, It asks for the number to be dialed of a master router and a backup router which should transmit the packet for the notice of failure generating with reference to routing table 15. When it detects that the

failure generated the packet for the notice of a failure which added the number to be dialed in the function outputted to WAN6, and the master router 1, after starting the backup router 2, it has the function to stop actuation of the master router 1.
[0027] The master router 3 has the same configuration as the master router 1. Moreover, although it has the configuration as the master router 1 also with the almost same backup routers 2 and 4, the notice section 20 of a failure is not formed in the backup routers 2 and 4, but the external I/O processing section 21 in the backup router 2 has further the function which copies the contents of routing table 15 other than the function with which the external I/O processing section 16 in the master router 1 is equipped to routing table 22 at the time of starting in them. In addition, the backup router 2, the external I/O processing section 21 in four, and each part other than routing table 22 are omitting illustration.
[0028] The flow chart in which drawing 4 shows the example of processing of the LAN side transceiver section 12, the flow chart in which drawing 5 shows the example of processing of the routing section 14, the flow chart in which drawing 6 shows the example of processing of the WAN side transceiver section, the flow chart in which drawing 7 shows the example of the failure judging section 18 of processing, the flow chart in which drawing 8 shows the example of the priority modification section 19 of processing, and drawing 9 are the flow charts showing the example of the notice section 20 of a failure of processing, and actuation of this example explains with reference to each drawing below.
[0029] First, actuation when both the master routers 1 and 3 are operating normally is explained.
[0030] The LAN side transceiver section 12 will output the packet to the routing section 14, if the packet (for example, packet which makes the destination terminal unit 9-j connected to LAN7) which makes the destination the terminal unit connected to other LANs on LAN5 appears (drawing 4 and S1 are YES) (S2).
[0031] If the above-mentioned packet is passed, the routing section 14 will ask for the network address a of LAN7 where terminal unit 9-j is connected based on the predetermined bit of the high order of the IP address which shows terminal unit 9-j added to it, and will look for the field where routing table 15 is searched and the network address a is stored further (drawing 5 , S11). Supposing the contents of now 15, for example, routing table, show drawing 2 , the routing section 14 will discover the 1st field #1.
[0032] Then, it judges whether the priority of the master router stored in field #1 of the routing section 14 is higher than the priority of a backup router (S12). Since in the case of this example the priority of a master router is "1" and the priority of a backup router is "2", the decision result of S12 serves as YES. When the decision result of S12 serves as YES, the routing section 14 passes the packet which added number-to-be-dialed A of the master router stored in field #1 to the packet passed from the LAN side transceiver section 12 to the WAN side transceiver section 13 (S13).
[0033] The WAN side transceiver section 13 will output the packet to WAN6, if the packet to which number-to-be-dialed A was added from the routing section 14 is passed (drawing 6 and S21 are NO) (S22). Thereby, as for the above-mentioned packet, a number to be dialed is sent to the master router 3 of "A", and the master router 3 is outputted to LAN7 to which this packet is connected in terminal unit 9-j.
[0034] Moreover, when the packet to which the WAN side transceiver section 13 makes the destination terminal unit 8-i connected to LAN5 through WAN6 has been sent, (S21 and S23 pass YES, NO), and its packet to the LAN side transceiver section 12, respectively (S25).
[0035] If a packet is passed from the WAN side transceiver section 13, as for the LAN side transceiver section 12, (drawing 4 and S1 will output the above-mentioned packet to YES) and LAN5 (S3). Thereby, terminal unit 8-i receives the above-mentioned packet.
[0036] Next, a failure occurs in the master router 3 and actuation in case the packet which shows failure generating from the master router 3 to the master router 1 has been sent is explained.
[0037] The WAN side transceiver section 13 of the master router 1 writes in the fault information included in the fault information section 17-2 at the packet while writing the information "ON" which shows failure generating in the failure generating display 17-1 of the fault information table 17, if the packet which shows that the failure occurred in the master router 3 through WAN6 is received (both drawing 6 , and S21 and S23 are YES) (S24).

[0038] If the failure generating display 17-1 is monitored continuously and the contents serve as "ON" (drawing 7 and S31 are YES), the failure judging section 18 will ask for the master router 3 which the failure generated based on the newest fault information stored in the fault information section 17-2, will ask for the network address a of LAN7 where the master router 3 is connected further, and will notify it to the priority modification section 19 (S32). Then, the failure judging section 18 changes the contents of the failure generating display 17-1 at "OFF" (S33).
[0039] The priority modification section 19 searches routing table 15 based on the network address a of LAN7 passed from the failure judging section 18, and looks for a field including a network address a (drawing 8 , S41). In the case of this example, the 1st field #1 of routing table 15 is discovered (refer to drawing 2). Then, the priority modification section 19 changes into "F" from "1" the priority of the master router 3 stored in field #1 discovered by S41 (S42).
[0040] The following actuation is performed, when the packet which makes the destination terminal unit 9-j connected to LAN7 appears on LAN5 after the priority of the master router 3 was changed into "F" from "1."
[0041] If the packet which makes terminal unit 9-j the destination appears on LAN5, the LAN side transceiver section 12 will pass the packet to the routing section 14 (drawing 4 , S1, S2).
[0042] If the above-mentioned packet is passed, the routing section 14 will perform same processing with having mentioned above, and will discover the 1st field #1 of routing table 15 (drawing 5 , S11). Then, the priorities of the master router stored in field #1 and a backup router are "F" and "2", respectively, and since the priority of a master router is lower, the routing section 14 passes the packet which added number-to-be-dialed A' of the backup router stored in field #1 to the packet to which (S12 were passed from NO) and the LAN side transceiver section at the WAN side transceiver section 13 (S14).
[0043] The WAN side transceiver section 13 will output the packet to WAN6, if the packet to which number-to-be-dialed A' was added from the routing section 14 is passed (drawing 6 and S21 are NO) (S22). Thereby, as for the above-mentioned packet, a number to be dialed is sent to the backup router 4 of "A'", and the backup router 4 outputs this packet to LAN7.
[0044] Next, actuation when a failure occurs in the master router 1 is explained.
[0045] when it detects that the failure generated the notice section 20 of a failure in the master router 1 in the master router 1, it is shown in the flow chart of drawing 9 -- as -- first -- routing table 15 -- each -- the priority of the numbers to be dialed of the master router stored in every field #1, #2, and -- to the field and a backup router acquires the number to be dialed of the higher one (S51). Then, the acquired packet for the notice of failure generating which added the number to be dialed for every number to be dialed is created, and each created packet is outputted to WAN6 through the WAN side transceiver section 13 (S52).
[0046] Subsequently, the notice section 20 of a failure outputs an error message to I/O device 10 while starting the backup router 2 which is the master router 1 and a pair (S53), and it stops the master router 1 further (S54).
[0047] If the external I/O processing section 21 in the backup router 2 is started, it will copy the contents of the routing table 15 in the master router 1 to the routing table 22 in the backup router 2. It enables this to succeed immediately the processing which the master router 1 was performing with the backup router 2.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the example of this invention.
[Drawing 2] It is drawing showing the example of contents of routing table 15.
[Drawing 3] It is drawing showing the example of a configuration of the fault information table 17.
[Drawing 4] It is the flow chart showing the example of processing of the LAN side transceiver section 12.
[Drawing 5] It is the flow chart showing the example of processing of the routing section 14.
[Drawing 6] It is the flow chart showing the example of processing of the WAN side transceiver section 13.
[Drawing 7] It is the flow chart showing the example of processing of the failure judging section 18.
[Drawing 8] It is the flow chart showing the example of processing of the priority modification section 19.
[Drawing 9] It is the flow chart showing the example of processing of the notice section 20 of a failure.
[Drawing 10] It is the block diagram of the conventional technique.
[Drawing 11] It is the block diagram of the technique considered in order to solve the trouble of the conventional technique shown in drawing 10 .
[Drawing 12] It is drawing for explaining actuation of drawing 11 .
[Description of Notations]
1 3 -- Master router
2 4 -- Backup router
5 7 -- LAN
6 -- WAN
8-1 - 8-N, 9-1 - 9-M -- Terminal unit
10 11 -- I/O device
12 -- LAN side transceiver section
13 -- WAN side transceiver section
14 -- Routing section
15 22 -- Routing table
16 21 -- External I/O processing section
17 -- Fault information table
18 -- Failure judging section
19 -- Priority modification section
20 -- Notice section of a failure

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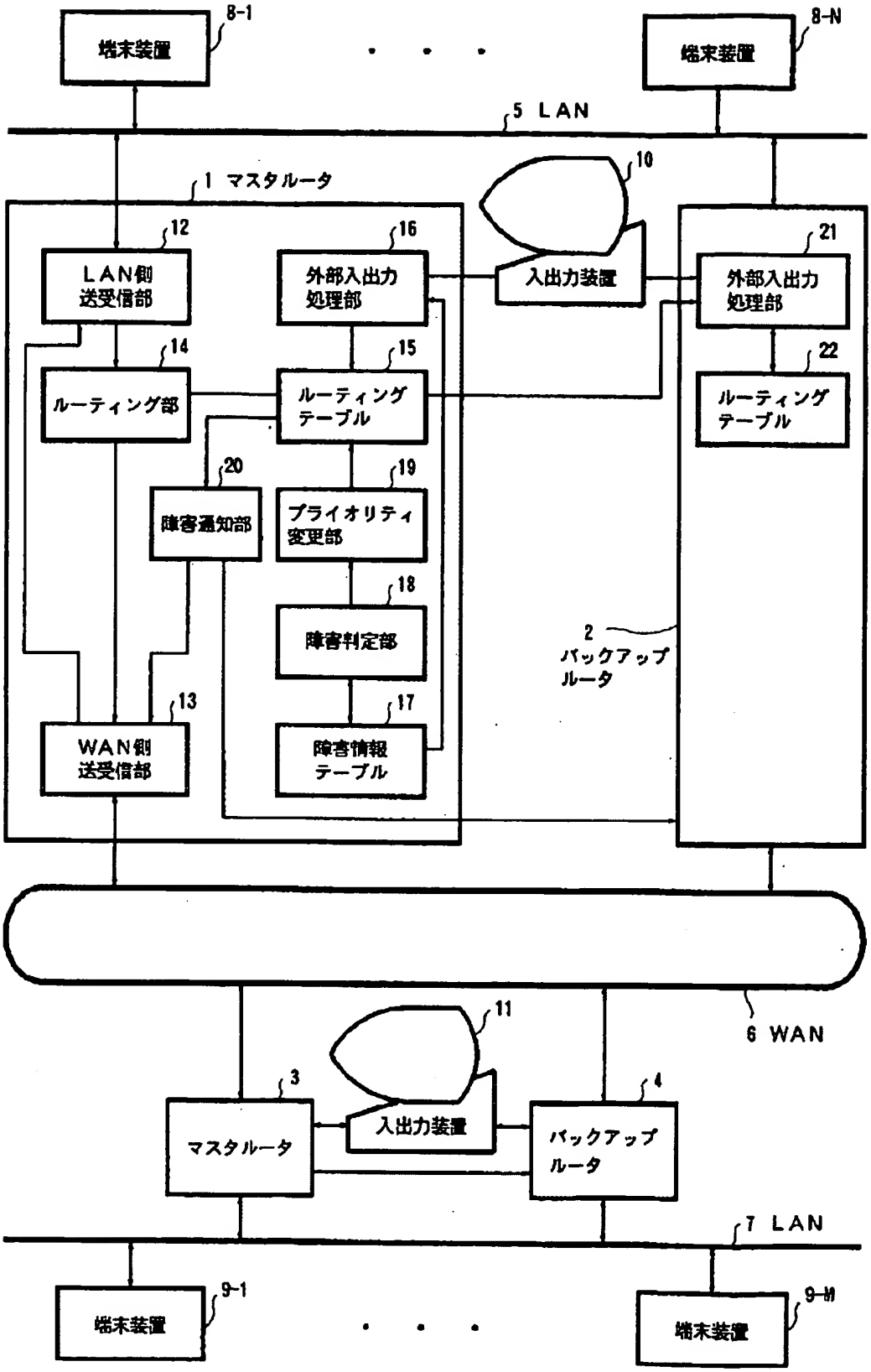
DRAWINGS

[Drawing 1]

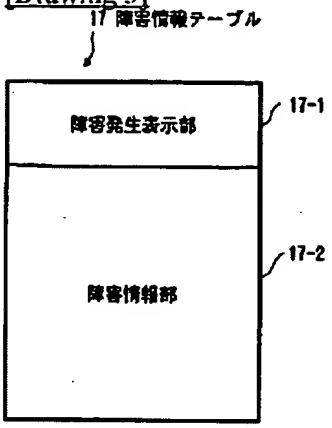

端末装置
8-1
端末装置
8-N
5 LAN
1 マスタルータ
10
12
LAN側
送受信部
16
外部入出力
処理部
入出力装置
21
外部入出力
処理部
14
ルーティング部
15
ルーティング
テーブル
22
ルーティング
テーブル
20
障害通知部
19
プライオリティ
変更部
18
障害判定部
2
バックアップ
ルータ
13
WAN側
送受信部
17
障害情報
テーブル
6 WAN
11
3
マスタルータ
入出力装置
4
バックアップ
ルータ
7 LAN
端末装置
9-1
端末装置
9-M

[Drawing 2]

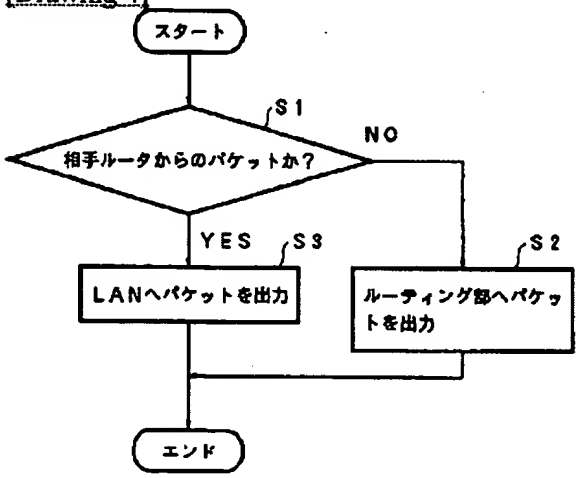
15 ルーティングテーブル

	種別	ダイヤル番号	ネットワークアドレス	プライオリティ
#1	マスタ バックアップ	A A'	a	1 2
#2	マスタ バックアップ	B B'	b	1 2
⋮				

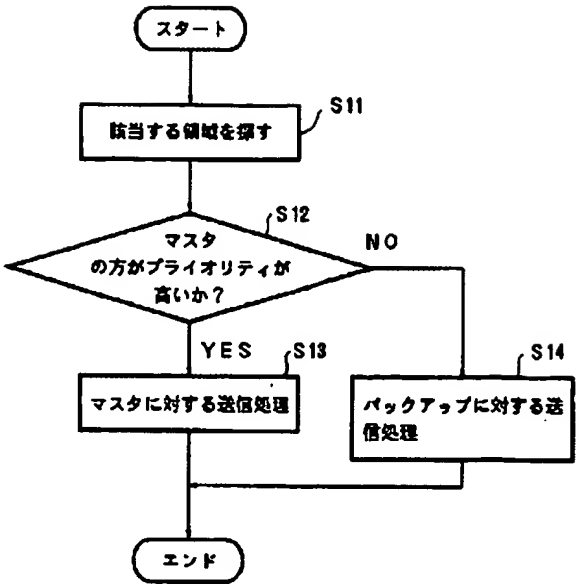
[Drawing 3]



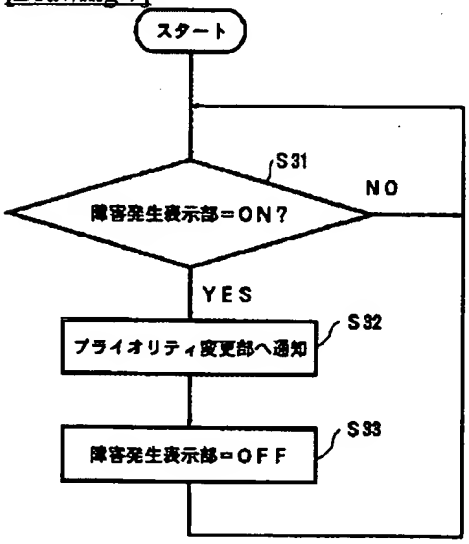
[Drawing 4]



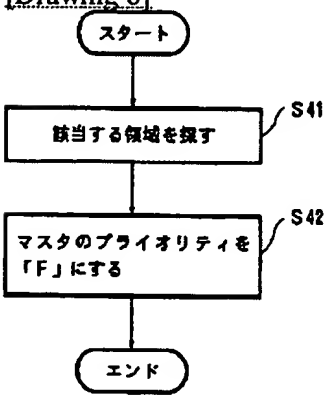
[Drawing 5]



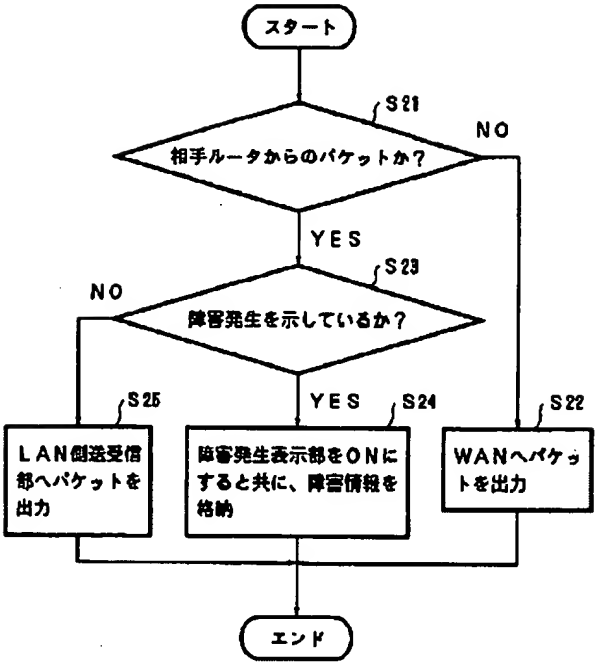
[Drawing 7]



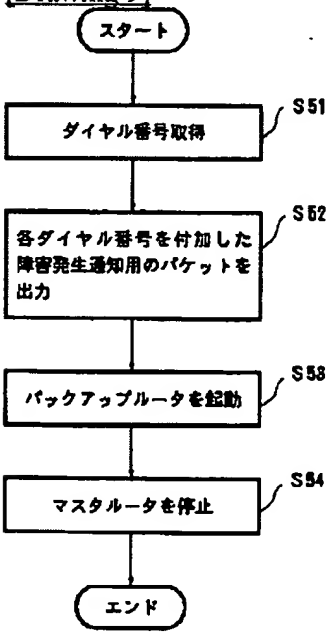
[Drawing 8]



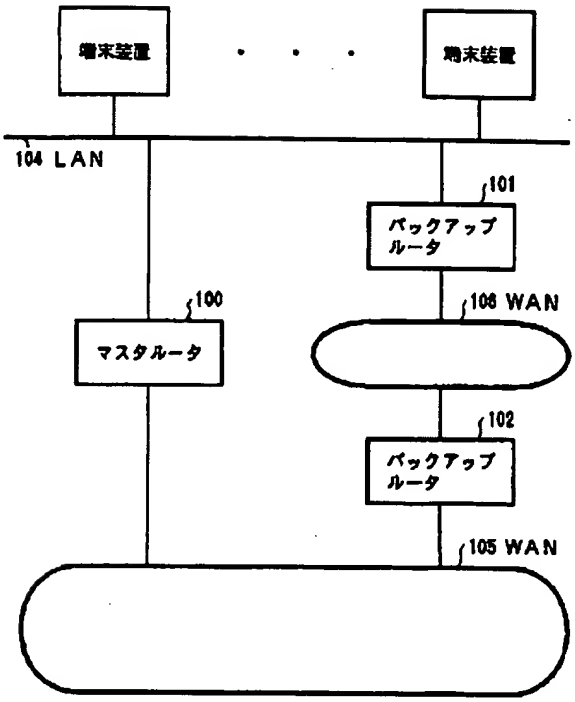
[Drawing 6]



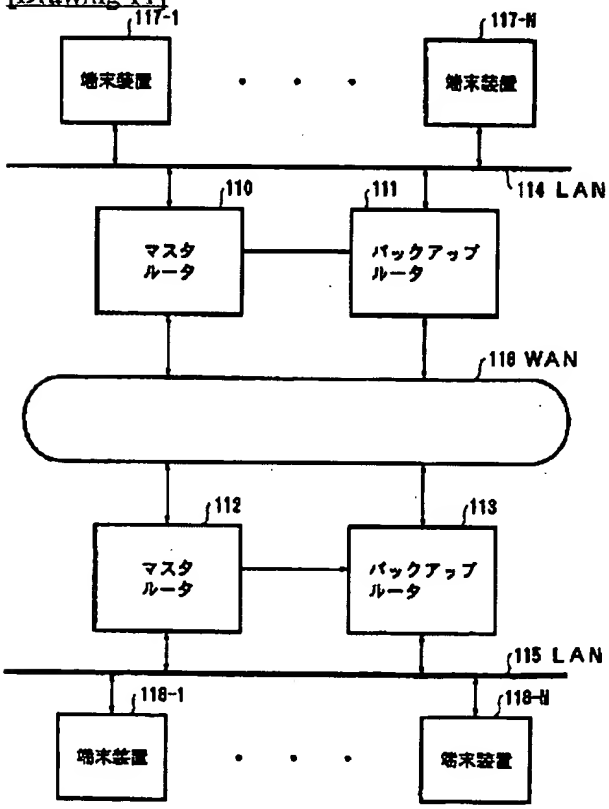
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Drawing 12]

(A)

ダイヤル番号	ネットワークアドレス
Y	y

(B)

ダイヤル番号	ネットワークアドレス
X	x

(C)

ダイヤル番号	ネットワークアドレス
Y'	y

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